Economic Analysis

Research Paper Series

The Trend to Smaller Producers in Manufacturing: A Canada/U.S. Comparison

by John R. Baldwin, Ron S. Jarmin and Jianmin Tang

No. 003

Statistics Canada Statistique Canada

Canada

ECONOMIC ANALYSIS RESEARCH PAPER SERIES

The Economic Analysis Research Paper Series provides for the circulation of research conducted by the staff of National Accounts and Analytical Studies, visiting Fellows and academic associates. The research paper series is meant to stimulate discussion on a range of topics including the impact of the New Economy, productivity issues, firm profitability, technology usage, the effect of financing on firm growth, depreciation functions, the use of satellite accounts, savings rates, leasing, firm dynamics, hedonic estimations, diversification patterns, investment patterns, the differences in the performance of small and large, or domestic and multinational firms, and purchasing power parity estimates. Readers of the series are encouraged to contact the authors with comments, criticisms and suggestions.

The primary distribution medium for the papers is the internet. These papers can be downloaded from the internet at www.statcan.ca for free. Papers in the series are distributed to Statistics Canada Regional Offices and provincial statistical focal points.

All the papers in the Economic Analysis Research Paper Series go through institutional and peer review to ensure that they conform to Statistics Canada's mandate as a government statistical agency and adhere to generally accepted standards of good professional practice.

Publications Review Committee
Analytical Studies Branch, Statistics Canada
24th Floor, R.H. Coats Building
Ottawa, Ontario, K1A 0T6
Telephone: (613) 951-1804

The Trend to Smaller Producers in Manufacturing: A Canada/U.S. Comparison

by

John R. Baldwin *
Ron S. Jarmin **
Jianmin Tang ***

11F0027 No. 003
ISSN: 1703-0404
ISBN: 0-662-32175-8

No. 003

* Micro Economic Analysis Division
24th Floor, R.H. Coats Building
Statistics Canada
Ottawa, K1A 0T6
(613) 951-8588
Fax: (613) 951-5403
E-mail: baldjoh@statcan.ca

** Center for Economic Studies
U.S. Bureau of the Census
(301) 457-1858
Fax: (301) 457-1235
Email: rjarmin@ces.census.gov

*** Micro-Economic Policy Analysis Branch
Industry Canada
(613) 946-1621
Fax: (613) 991-1261
Email: tang.jianmin@ic.gc.ca

May 2002

The authors' names are listed alphabetically.

The findings of this paper are those of the authors and do not reflect either those of Statistics Canada or the U.S. Census Bureau.

Aussi disponible en français

Table of Contents

Abstract

This paper examines the trend in the importance of small producers in the Canadian and U.S. manufacturing sectors from the early 1970s to the late 1990s. It finds similar trends in both countries. Small plants increased their share of employment up to the 1990s but their share remained stable in the 1990s. Small plants increased their share of output up to the 1990s but then saw their share of output decline. Over the entire time period, their share of output increased less than their share of employment and, therefore, their relative labour productivity has fallen. The similarity in the trends in the two countries suggests that causes of this phenomenon should be sought in similarities such as the technological environment rather than in country specific factors like unionization or trade intensities.

Keywords: small business, productivity, employment growth

Executive Summary

The growing importance of small plants is seen as a sign that there has been a radical shift in the ability of small producers to compete with large producers that is leading to the decline of large firms and the growth of smaller firms. This paper looks at the evidence for the Canadian manufacturing sector over the last quarter of a century to discern trends in the importance of small producers. It focuses on whether the trends that were observed earlier in the 1970s and 1980s have continued into the 1990s. It also asks whether the events in Canada are unique by comparing the Canadian experience to that of the United States.

The paper focuses on five key questions. They are:

1) What has been the trend in the share of employment accounted by small plants in the Canadian manufacturing sector?

During the 1970s and 1980s, small Canadian plants increased their share of employment. But the 1990s have put an end to this trend. The employment share of smaller plants has been relatively stable in the 1990s.

2) Have small Canadian plants increased their share of output in this sector as much as they increased their share of employment?

During the 1970s and 1980s, small Canadian plants increased their share of output. But during the 1990s, their share has begun to fall. Together the evidence on both employment and output suggests that the era of increasing importance of small producers, at least in manufacturing, has come to an end.

3) What has happened to the relative labour productivity of small Canadian plants in the manufacturing sector?

The relative labour productivity of small Canadian plants fell during the 1970s and 1980s as their share of output increased at a slower rate than did their employment share. In the 1990s, their relative labour productivity continued to fall. Small plants continue to fall behind large plants either because they are less capital intensive or because they are less efficient.

4) Is there a difference between the importance of small plants in the manufacturing sectors of Canada and the United States?

Canada has a larger proportion of employment in small plants than does the United States. But the trend over the last quarter century has been similar in the two countries. Indeed the percentage point change in employment in smaller plants is about the same in the two countries.

5) Has there been a similar trend in the falling productivity of smaller manufacturing plants in the two countries?

Both countries have experienced a decline in the relative productivity of small plants relative to large plants. The similarities in this area suggest that it is commonalities in the technological environment that are driving the changing relative productivity of small and large plants rather than country-specific factors such as unionization or trade intensities.

Acknowledgements

We would like to thank Richard Dupuy of Business and Labour Market Division for the data used in Table 4. Richard Vincent of Manufacturing Division clarified the practices used in defining value-added over time. Comments are gratefully acknowledged from Yussef Siddiqqi of the Input/Output Division.

1. Introduction

Debates on industrial policy have focused during much of the post-war period on the necessity of providing special support toward the small-firm sector. Many policy interventions during this period have been directed towards the adequacy of financing for this sector.

During the 1970s and 1980s, concerns for the interests of the small-firm sector were attenuated by research results that appeared to show that the small-firm sector, far from being moribund, was actually one of the most dynamic of the economy—at least when it came to employment growth.

Interest in the importance of small firms has been driven by studies that show the proportion of employment in small firms or small plants has been increasing in many European and North American countries (OECD, 1985). This change, it was pointed out, came not so much from the fact that large firms were decreasing their work force—as the fact that net job growth was much faster in small firms than in large firms (Birch, 1981, 1987; Armington and Odle, 1982).

In these studies, job growth was measured as the sum of job increases due to the creation of new firms and the expansion of existing ones. Job contraction was measured as the destruction of jobs in firms that exited industries and the reduction in jobs in firms that were contracting. Net job growth for a particular size class is just the difference between job growth and job contraction for all firms in a particular size class.

Job growth was found to be larger in smaller firms as a whole because small firms were being created at a faster pace than were large firms and the employment in small firms was expanding faster than that of large firms. Kirchoff and Phillips (1988) note that in the case of the United States, the majority of job creation came from entry rather than small-firm growth. Similar results have been reported for Canada (Baldwin and Gorecki, 1990; Baldwin and Gorecki, 1994).

The findings of these studies were, at first, greeted with criticism. At first, the criticism focused on the accuracy of the data that was used for measurement of job change (MacDonald, 1985; Storey and Johnson, 1986; Reynolds et al., 1985). But others criticized the job-change studies for failing to take into consideration the Galtonian regression-to-the-mean effect when estimating the rate of net job change by size class (Davis, Haltiwanger and Schuh, 1993). Job growth tends to follow a random walk with negative serial correlation. Fast growth in one period is followed by slower growth in the next period. In a world where growth consists of a random variation of firm size around a long-run value, failing to take this into account when rates of job change are compared across different size classes could lead to the mistaken impression that small firms are growing and large firms are declining.

A third voice in the debate was raised by Brown, Hamilton and Medoff (1990), cautioning that small-firm growth is not necessarily beneficial. The theme that small firms are especially innovative (Rothwell and Zegveld, 1982; Acs and Audretsch, 1990) has reinforced the interest that has been expressed in small-firm growth. But Brown, Hamilton and Medoff point out that

not all small firms are innovative and that many small firms tend to have jobs that are much more unstable, with higher turnover rates. Moreover, small firms pay lower wages than large firms.

2. *The Canadian Evidence*

Canadian studies that have focused on the growing importance of small firms have dealt with the effect of each of the three issues—data quality, methodology and the effect of small- and large-firm wage differences—that were raised about the validity of Birch's conclusion that small firms create more jobs than large firms.

2.1 Data Quality

Baldwin and Gorecki (1990) examine job change in the Canadian economy and deal with the early criticism levied at the quality of U.S. studies based on Dun and Bradstreet data by using comprehensive data bases from Statistics Canada for both the manufacturing and the service sectors to examine the differences in rates of job growth in small and large firms. As was the case in the United States (Birch, 1981, 1987), the Canadian evidence also showed that job growth has been higher in smaller than in larger firms.

Despite this finding, Baldwin and Gorecki (1990) were careful to point out that some of these differences were simply the result of a statistical effect that results from the rates of job change being truncated for the very smallest and the very largest firms. The net job-change rate (job change divided by original employment) of any size class is measured by the rate of job gain minus the rate of job loss. The latter is truncated in small firms because the rate of job decline is bounded below by zero. Employment cannot turn negative in a firm and thus decline *rates* tend to be lower in small firms simply because the range of possible declines is restricted in small firms compared to larger firms. By contrast, the *rate* of job gain is truncated above in large firms compared to small firms by the natural limit placed on firm size by organizational constraints and the fact that large firms are closer to this ceiling than are small firms. The range of possible job-rate increases is less for large than small firms. Because of these two similar but opposite truncation effects, even if job change was unrelated to size of firm, the very smallest firms should always show larger net job growth and the very largest should show less net job growth.

2.2 Regression-to-the-mean

Various methods are available to correct for the regression-to-the-mean problem and have been employed in Canadian studies.

The problem of Galtonian movement in short-run measures of job change was dealt with in the earlier Baldwin and Gorecki (1990, 1994) studies by examining change over five-year rather than one-year periods. This reduces the effect of short-term random fluctuations and places greater emphasis on longer-term trends. When this is done, these studies still demonstrate that the smaller size classes tended to create more jobs than were lost.

More evidence on this has been provided by Baldwin and Picot (1995) and Picot, Baldwin and Dupuy (1995) who show that other means of correcting for the regression-to-the-mean phenomenon in Canada[1] still left small firms growing faster than large firms—especially compared to the United States.

More importantly, the share of employment in small plants and firms, a direct measure of the growing importance of small firms, generally increased over the period up to 1990. This trend was particularly marked for the manufacturing sector, where the share of small plants increased by about 10 percentage points between the early 1970s and the beginning of the 1990s (Baldwin, 1998). Similar results were also reported by Picot and Dupuy (1996) for both the manufacturing and service sectors taken together.

Together, the size-class differences in net job growth and the changes in the employment distribution reinforced the conclusion that a change in the firm-size distribution was basically caused by growth in the small-firm sector rather than a decline in larger firms. Much of this came from the creation of new small firms.

2.3 Quality of Small Firm Jobs

The applicability of the Brown, Hamilton, and Medoff (1990) observation that U.S. small firms pay lower wages has been confirmed for Canada by Morissette (1993). Canadian data from a household survey linking worker wages to a worker's characteristics, such as education and experience, show that wage rates are lower in smaller firms, even after the difference in worker characteristics between small and large firms is taken into account.

Baldwin (1998) also finds that average wages of all production workers in manufacturing plants are lower in smaller plants. More importantly, the average wage paid in small plants had fallen more or less continuously during the 1970s and 1980s. When jobs are standardized for wage-rate differences between small and large plants,[2] job growth in small plants was found to be similar to that in large plants.

In the same cautionary vein, Baldwin (1996) pointed out that, over the 1970s and 1980s, the labour productivity of new small plants in manufacturing fell relative to larger plants. While the small-plant population may have been increasing its share of employment due to the entry of new small plants, it did not increase either its share of shipments or its share of value-added nearly as rapidly as its share of employment (Baldwin, 1998). This meant that the labour productivity of small plants, which is generally lower than in large plants, fell over the period relative to larger plants.

---

[1] They chose to use averages of employment over several previous periods to average out the effects of yearly change.

[2] Wage corrected employment was measured by employment divided by a plant's wage per person employed relative to the industry mean.

On both counts then, taking into consideration the declining relative labour productivity and the declining average wage rates of smaller plants qualifies the unbridled enthusiasm that initially greeted the observation that the employment share of small producers had increased over time.

The important conclusion to be drawn from these studies was that while small firms may have increased their share of employment, they could not unambiguously be regarded as the dynamos of growth. The emergence of new, less productive manufacturing firms accounting for a larger percentage of employment would have slowed growth in productivity. Of course, the latter might simply be the result of outsourcing—of larger firms spinning off their less productive activities to outside sources. But if this is the explanation for the falling relative productivity of smaller firms, the growth of this sector does not presage the dramatic emergence of a new small-firm sector that will compete with larger firms—rather it simply indicates a restructuring of existing firms.

While our previous studies have delineated the importance of small firms in Canada, they leave several gaps in our knowledge. The first is the extent to which the trend in the growth of small firms that was observed in the 1970s and 1980s has continued into the 1990s. In particular, we wish to examine the extent to which small firms have continued to increase in importance. If small firms have continued to increase in importance, this suggests that the same set of forces have been at work continuously over the period.

In the second instance, we wish to compare differences in the size distribution of plant sizes and changes in these distributions that have occurred in Canada and the United States. Similarities between Canada and the United States imply that the forces that are changing the importance of small firms are not country-specific.

A comparison of changes in the size distribution in Canada and the United States also permits us to investigate a potential cause in the widening of the Canada/U.S productivity gap. The level of labour productivity in Canadian manufacturing compared to that of the United States is of constant interest to Canadian policy makers. Relatively higher growth in small, less productive producers in Canada does not at first glance reduce the difference between the two countries and may very well have decreased Canadian productivity relative to the United States. But differences in the productivity performance of Canada and the United States depend not only on events in Canada; they also depend upon whether the firm-size structure in the United States is changing in similar or different ways. Therefore, an evaluation of the effect of changes in the size distribution of employment in Canada requires a cross-country comparison of the changes in Canada to the changes that were taking place at the same time in the United States.

The paper is organized as follows. In part one, we examine the evidence specifically for Canada. In the second section, we compare changes occurring within Canada to changes occurring within United States.

3. *Continuance of Trend in the 1990s?*

In this section, we review the Canadian evidence on the change that has taken place in the manufacturing sector and examine whether the previously observed trends have continued into the 1990s. Data that were previously only available to the early 1990s are now available up to 1997. We are interested in whether small producers have continued to grow and whether their relative productivity has continued to decline.

3.1 Data

In examining data on the differences between small and large producers, it is always important to keep in mind the manner in which the data are constructed—because trends may just be the product of the way in which data are collected or created.

In this study, we examine data on the relative importance of plants of different sizes[3] that are taken from Statistics Canada's micro-economic records of manufacturing plants. Small plants are defined in this study as those with 0 to 100 employees, medium-sized plants from 101 to 500 employees, and large plants are those with over 500 employees.

We choose to examine the relative importance of producers of different sizes by using plant data. Use of plant rather than firm data allows us to examine whether the economics of production at the lowest unit—the production establishment—has changed over time. Changes in the relative size of firms are the joint result of changes in establishment size and the number of establishments owned. The two may move in quite opposite directions if the economies of plant size and the economies of multi-plant ownership are moving in different directions.

A study of changing multiplant operations shows that the number of plants per multiplant firm has fallen in recent years (Baldwin, Beckstead, and Caves, 2001). Thus firm-level data will overestimate the extent to which plant-scale economies have increased.

In this study, we first compare employment and output share of small and large plants. Employment is defined as the sum of production and non-production workers. Output is defined alternately as shipments and value-added. Value-added is the difference between shipments and intermediate expenditures—on materials, services, and energy.[4]

The advantage of using value-added is that its sum across all stages of the production process is gross domestic product (GDP). Value-added in any industry is the contribution that the industry makes to the economy's gross domestic product. Value of shipments, on the other hand, measures the total shipments or revenue of an industry and cannot be summed across industries to obtain gross domestic product because this sum contains considerable double counting. Sales or shipments can increase in an industry or sector, even when value-added does not increase, if

[3] We include both head office and operating plants.
[4] Census value-added is larger than GDP or value-added since services are not deducted.

the degree of vertical integration changes. For example, a firm may increase its outsourcing. If this is the only change occurring, then the firm's shipments would remain unchanged, but its value-added would decrease and the amount of materials and services that it used would increase.

For this reason, it is common for many studies of productivity to focus on value-added per worker. But there are reasons not to rely on this measure alone.

First, measures of shipments for a sub-population like small plants may be more accurate than measures of value-added. In our comparisons, we use data from the micro-economic files maintained by the Micro-Economics Studies and Analysis Division that are derived from the files generated by the Manufacturing Division on individual manufacturing plants. These files come from detailed surveys that are sent to plants above a certain size threshold and on administrative records taken from tax files for the smallest firms. The surveys are divided into more detailed long-form questionnaires that are answered by large firms and much less detailed short-form questionnaires that are answered by smaller firms. Data for the smallest firms are taken from administrative records and provide a more restricted range of data—such as revenues, total wages and salaries and net income. The other variables that are normally captured by surveys (such as value-added) are added to the administrative records by an imputation procedure—using data on the relationship between the observed and unobserved data that are taken from the long- and short-form surveys. In all three sets of data (long-form, short-form and administrative records), value of shipments is measured directly from revenues of the plant. Moreover, all records measure value-added (what is often referred to as census value-added) as inclusive of payments for services and therefore are not identical to the National Accounts GDP concept.[5] As a result, changes over time in value-added per worker of different size classes taken from the administrative file may be less accurate than the shipments per worker.

There is a second reason for using both shipments per worker and value-added per worker as measures of output per worker. Both of these are measures of productivity—labour productivity—but they are affected by different factors. Labour productivity can increase over time because the other inputs available to workers increase. If capital per worker increases, so too will both measures of labour productivity and this will be captured by both measures. However, if the amount of materials inputs increases per worker, labour productivity may also change. And here, value-added per worker will not capture this phenomenon, but shipments per worker will do so. Measuring output per worker just as value-added per worker is appropriate only if materials per unit of shipments or the value-added component of shipments remains constant—or if the production function for shipments is entirely separable into the value-added component and the other inputs (materials and services) component. This is rarely the case.

For these reasons, we use both measures of output in the following section.

[5] The adjustments differ for the period before and after 1980. From 1980 onward, census value-added on both short and long-form records includes purchased services. Before 1980, short-form census value-added excludes purchased services but long-form value-added does not.

We will examine the share of employment, shipments and value-added in small, medium, and large plants and compare their course over the 1970s, 1980s, and 1990s. Shares using employment and shipments for the period 1973 to 1997 are included in Table 1. Shares using employment and value-added are included in Table 2.[6] In each case, the relative output per worker for a given size class is calculated by dividing the output share of a size class by its employment share, which gives the ratio of the size class's relative productivity to average industry productivity—where both are weighted estimates with the weights based on employment. The estimates of relative output per employee using shipments and value-added are plotted in Figures 1 and 2, respectively. In Table 3, we present the ratio of the weighted estimates of the productivity of small to medium, small to large and medium to large size plants, using both measures of output—shipments and value-added.

Table 1. Distribution of Manufacturing Employment and Shipments by Plant Size Class: Canada

Year	Employment (% of total)			Shipments (% of total)			Relative % of Shipments/ % of Employment		
	Small	Med	Large	Small	Med	Large	Small	Med	Large
73	28.6	39.4	32.0	23.1	37.2	39.7	80.9	94.3	124.0
74	28.4	39.1	32.5	22.7	37.6	39.7	80.0	96.0	122.3
75	30.7	38.6	30.7	23.7	38.2	38.1	77.2	98.9	124.1
76	30.6	38.4	31.1	22.9	37.6	39.5	74.9	98.2	127.0
77	30.4	38.1	31.6	22.0	37.0	41.0	72.4	97.1	130.0
78	31.6	37.6	30.8	22.4	36.8	40.8	70.8	98.0	132.4
79	31.4	37.8	30.8	23.9	38.3	37.8	76.0	101.3	122.9
80	32.0	37.8	30.2	23.7	38.2	38.2	73.9	101.1	126.3
81	31.9	37.8	30.3	24.4	38.9	36.7	76.4	102.9	121.3
82	34.2	37.1	28.7	25.0	39.4	35.6	73.1	106.3	123.8
83	35.0	37.8	27.3	24.5	39.9	35.6	70.2	105.6	130.5
84	34.4	37.9	27.6	23.7	38.4	37.9	68.8	101.3	137.1
85	34.9	37.9	27.2	23.5	38.4	38.1	67.4	101.2	140.2
86	35.9	37.8	26.3	24.8	37.3	37.9	69.1	98.7	144.0
87	35.1	38.7	26.2	24.4	38.4	37.2	69.5	99.3	142.0
88	36.8	37.5	25.7	24.6	37.3	38.1	66.9	99.4	148.1
89	38.0	36.8	25.2	25.3	37.5	37.1	66.6	102.0	147.6
90	39.4	36.2	24.4	26.2	38.5	35.3	66.5	106.4	144.6
91	39.6	35.9	24.5	25.8	37.7	36.5	65.2	104.9	148.9
92	38.1	37.6	24.2	24.4	39.4	36.2	64.0	104.8	149.3
93	38.1	38.5	23.4	23.5	38.1	38.4	61.7	99.0	164.0
94	37.3	39.3	23.4	22.5	37.8	39.7	60.1	96.3	170.0
95	36.8	39.5	23.7	21.6	38.3	40.1	58.6	97.0	169.2
96	38.3	39.0	22.7	23.0	39.0	37.9	60.1	100.1	167.3
97	37.3	39.8	22.9	23.0	39.3	37.7	61.7	98.7	164.8

[6] For this table, the raw figures on value-added are taken from the micro-records and adjusted prior to 1980 by reducing the value-added on long-form records by a fraction so that the sum of census value-added from short-form records plus the adjusted long form value-added was equal to GDP in manufacturing. From 1980 onward, both short- and long-form records were adjusted downward by the same fraction so that the sum of the adjusted value-added of both was equal to GDP in manufacturing.

Table 2. Distribution of Manufacturing Employment and Value-added by Plant Size Class: Canada

Year	Employment (% of total)			Value-added (% of total)			Relative % of Value-added/ % of Employment		
	Small	Med	Large	Small	Med	Large	Small	Med	Large
73	28.6	39.4	32.0	23.4	37.6	39.0	81.9	95.4	121.9
74	28.4	39.1	32.5	22.9	37.6	39.4	80.7	96.2	121.5
75	30.7	38.6	30.7	25.0	38.4	36.6	81.4	99.5	119.2
76	30.6	38.4	31.1	24.2	38.6	37.2	79.1	100.7	119.7
77	30.4	38.1	31.6	23.7	38.0	38.3	78.1	99.8	121.3
78	31.6	37.6	30.8	24.7	37.4	37.9	78.1	99.4	123.1
79	31.4	37.8	30.8	24.9	38.1	37.0	79.2	100.8	120.3
80	32.0	37.8	30.2	24.9	38.0	37.1	77.7	100.7	122.8
81	31.9	37.8	30.3	25.1	38.0	36.8	78.9	100.6	121.5
82	34.2	37.1	28.7	27.5	38.3	34.2	80.6	103.2	119.0
83	35.0	37.8	27.3	27.0	38.6	34.4	77.3	102.1	126.2
84	34.4	37.9	27.6	26.3	38.1	35.6	76.4	100.5	128.7
85	34.9	37.9	27.2	26.6	38.7	34.7	76.2	102.0	127.7
86	35.9	37.8	26.3	26.9	39.4	33.7	75.1	104.0	128.2
87	35.1	38.7	26.2	25.8	39.0	35.2	73.3	100.9	134.5
88	36.8	37.5	25.7	25.5	38.8	35.7	69.4	103.3	138.9
89	38.0	36.8	25.2	26.5	38.5	35.0	69.6	104.6	139.3
90	39.4	36.2	24.4	28.5	39.2	32.3	72.4	108.2	132.3
91	39.6	35.9	24.5	28.4	39.7	31.9	71.7	110.5	130.3
92	38.1	37.6	24.2	27.3	41.0	31.8	71.5	108.9	131.0
93	38.1	38.5	23.4	26.2	41.0	32.8	68.8	106.5	140.2
94	37.3	39.3	23.4	25.3	41.8	32.9	67.7	106.4	140.9
95	36.8	39.5	23.7	23.4	41.6	35.0	63.6	105.2	147.8
96	38.3	39.0	22.7	25.3	41.7	33.0	66.0	107.0	145.4
97	37.3	39.8	22.9	25.1	41.3	33.6	67.2	103.8	146.9

4. Comparison of 1990s to Earlier Period

The data show that the long-term growth in the relative importance of the small-plant sector has come to an end in the 1990s, but not its long-term decline in relative labour productivity. Each of these will be investigated in turn.

4.1 Employment

During the 1970s, the employment share of small plants increased by 3 percentage points from 29% to 32%. It then climbed by 7 percentage points to 39% in 1990 for a cumulative growth of over 10 percentage points between the early 1970s and 1990. It was this increase in employment share that generated so much interest in small-business success.

It is noteworthy that this trend has not continued into the 1990s. Since 1990, the employment share of small plants has *not* continued to grow; indeed, it has decreased to about 37% by 1997.

Over the 1970s and 1980s, both medium and large plants shared the decline in employment. In the 1970s, medium-sized plants saw their share decline by 1.6 percentage points while large plants declined by 1.8 percentage points. From 1980 to 1990, these declines were 1.6 and 5.8 percentage points, respectively, with large plants bearing the brunt of the decline.

During the 1990s, medium sized plants have increased their share by 3.6 percentage points while large plants have lost another 1.5 percentage points of employment share.

The 1990s then have seen the continued decline in the share of employment in large plants, the termination of the growing share of employment in small plants and the growing importance of the medium-sized sector.

4.2 Output

The change in output share is much less dramatic than in employment share. While small plants increased their share of employment between 1973 and 1990 by 10.8 percentage points, they increased their share of shipments by only 3.1 percentage points and their share of value-added by only 6.4 percentage points.

While the employment share of small plants stabilized during the 1990s, their share of output declined during this decade—by about 3 percentage points when measured in terms of shipments and about 3.4 percentage points when measured in terms of value-added. On the other hand, the output share of medium and large plants, whether measured in terms of shipments or value-added increased in the 1990s.

4.3 Output per Worker

During the period up until 1990, the output share of small plants increased by less than the employment share of small plants. As a result, the ratio of shipments to employment or value-added to employment of small plants relative to the industry average declined over the two decades (Figures 1 and 2). The shipment to employment ratio in small plants declined from 81% of the average in 1973 to 74% by 1980 to 67% by 1990 (Table 1). The value-added to employment ratio of small plants declined from 82% of the average in 1973 to 78% in 1980 to 72% in 1990 (Table 2).

Since 1990, small plants have experienced a stable employment share but a declining output share and, therefore, their relative output per worker has continued to fall. During the 1990s, the output per worker ratio, as measured in shipments, declined from 67% to 62% of the average; when measured in value-added, it declined from 72% to 67% of the average.

The relative productivity performance of large plants is exactly the opposite of small plants. From 1973 to 1990, large plants lost more employment share than they lost in terms of output share. As a result, their relative shipments per worker increased from 124% of the average to 145% of the average and their relative value-added per worker from 122% to 132% of the average.

Figure 1

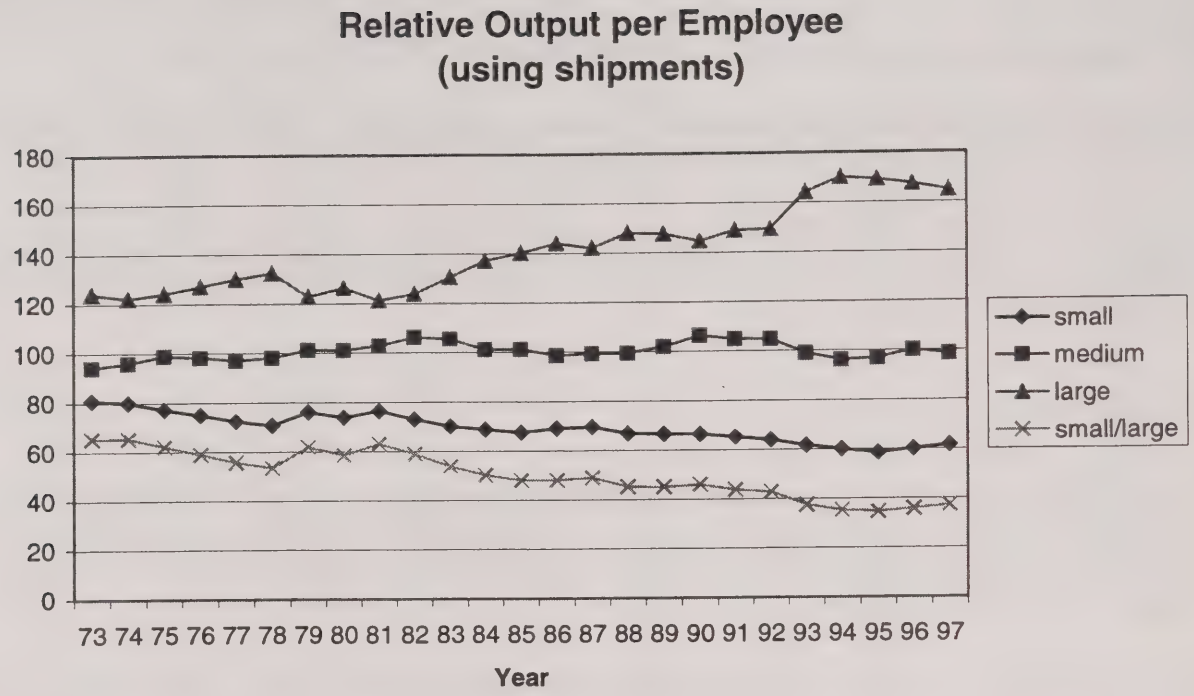
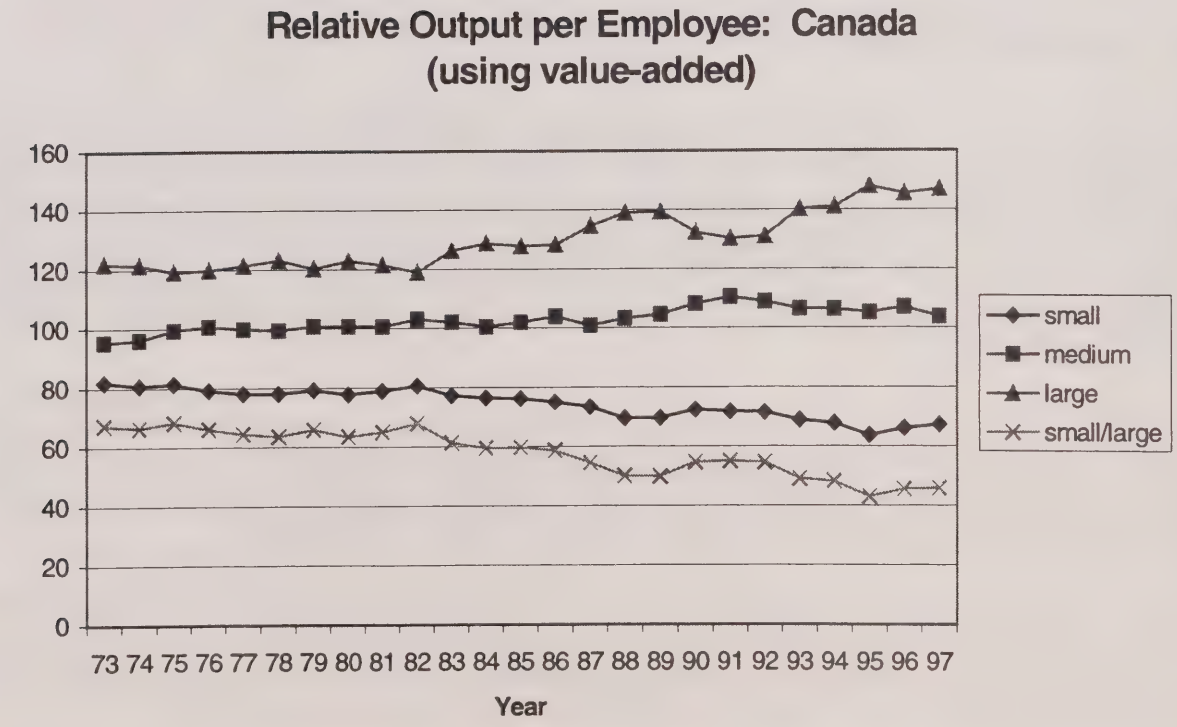


Figure 2



During the 1990s, the employment share of large plants continued to decline but their shipments share increased and as a result their relative shipments per worker jumped from 145% of the average in 1990 to 165% of the average by 1997. Their relative value-added per worker increased from 132% to 147% of the average by 1997.

Interestingly, the decline in the output per worker of small plants relative to large plants during the period 1973 to 1990 is duplicated in their decline relative to medium sized plants over the same period (Table 3). This parallel, however, does not exist during the 1990s. The difference between small and medium-sized plants stabilizes during this period. Large plants outperform both medium-sized plants and small plants in terms of labour productivity growth since 1990.

In conclusion, the growth of small plants has reached a plateau in the 1990s. They are no longer increasing their share of employment as they did for much of the two previous decades. And their share of output, whether measured in terms of shipments or value-added, is now declining.

On the other hand, one part of the long-run history has continued unabated into the 1990s. The relative labour productivity of small plants continues to decline relative to the largest plants.

Table 3. Relative Productivity of Small to Medium and Small to Large Plants: Canada

Year	Shipments per employee		Value-added per employee	
	Small/Large	Small/Medium	Small/Large	Small/Medium
73	65.3	85.8	67.2	85.9
74	65.4	83.3	66.4	83.9
75	62.2	78.0	68.3	81.8
76	59.0	76.3	66.0	78.5
77	55.7	74.6	64.4	78.3
78	53.4	72.2	63.5	78.6
79	61.9	75.1	65.8	78.6
80	58.5	73.1	63.3	77.2
81	63.0	74.3	64.9	78.4
82	59.0	68.8	67.8	78.1
83	53.8	66.4	61.3	75.7
84	50.2	68.0	59.4	76.1
85	48.1	66.6	59.7	74.7
86	48.0	70.0	58.6	72.2
87	48.9	70.0	54.5	72.7
88	45.2	67.4	50.0	67.2
89	45.1	65.3	49.9	66.5
90	46.0	62.5	54.7	66.9
91	43.8	62.2	55.0	64.9
92	42.9	61.1	54.6	65.7
93	37.6	62.4	49.1	64.6
94	35.4	62.5	48.1	63.6
95	34.7	60.4	43.0	60.4
96	35.9	60.1	45.4	61.7
97	37.4	62.5	45.8	64.8

4.4 Changes in Firm Size

In the previous section, we have examined long-run trends in the importance of small versus large producers using plant size. In this section, we examine whether an alternate database that provides measures of firm size confirms the difference between the 1990s and the earlier period.

The firm data are drawn from the remittance data that all firms must file with the Canadian taxation authorities for employees—listing total wages paid to employees. These data allow the employment size of firms to be tracked over time.[7] The measure of employment is derived by dividing wages by the average wage rate for firms in a comparable industry/region/size class.[8] While this database contains all firms in the economy, we examine here only those firms that are classified to the manufacturing sector. Since the data in this file go back only to 1983, we are restricted to a shorter period than was the case for the plant database used in the previous section.

We compare employment share in small, medium and large firms for the period 1983 to 1997 in Table 4 and plot the changes in Figure 3. The same size classes that were used before are adopted here. In absolute terms, about the same percentage of employment is found in small firms as was reported in small plants—because small firms are generally single establishments. But a much greater percentage is found in large firms than was reported in large plants since large firms generally possess multiple plants.

During the period from 1983 to 1990, the share of employment in small firms increases by almost 4 percentage points from 28.3% to 32.1%. The share of employment in large firms declines from 51.0% to 47.3%. These changes mirror what was happening in plants.

Table 4. Employment by Firm Size Class in Manufacturing in Canada

Year	Employment (% of total)		
	Small	Medium	Large
83	28.3	20.8	50.9
84	29.0	21.0	49.9
85	29.7	21.1	49.2
86	30.3	21.1	48.6
87	30.7	21.0	48.3
88	30.9	21.3	47.8
89	31.1	21.2	47.7
90	32.1	20.7	47.2
91	32.1	20.3	47.6
92	32.4	20.7	46.9
93	32.2	21.2	46.7
94	30.7	23.6	45.7
95	29.5	25.0	45.5
96	31.1	23.4	45.5
97	32.0	23.1	44.9

[7] See Baldwin, Dupuy and Penner (1992) and Picot and Dupuy (1996) for a description of the file.
[8] The wage data are taken from the Survey of Employment, Payroll and Hours.

The small-firm employment share falls in the early 1990s and just recovers its 1990 level by 1997. On the other hand, the share of large firms continues to decline in the 1990s by about 3 percentage points. Thus, like the plant data, the employment shares found in small firms stops rising in the 1990s, while large-firm employment share continues to decline.

5. Canada/U.S. Comparisons

Various causes have been suggested for the increase in the importance of small producers that has occurred in Canada.

First, increases in small producers may reflect the increased need for the type of flexibility that small firms offer. It may be that changes in advanced manufacturing technology have increased the flexibility of small producers and, therefore, the relative advantage that small producers have always possessed. Or these technological changes may have reduced the advantages of scale possessed by large plants. Or it may be that consumer demand has shifted to require more of the goods and services that small plants have a comparative advantage in producing.

Second, the increased importance of small plants may be the result of increased outsourcing by large producers. New advanced technologies may not so much have affected the type of scale economies in assembly that large producers enjoy as it has affected the advantage or disadvantage of organizing all the production stages within the firm. Advanced communications technologies may have made it easier to outsource functions that were once conducted within the firm via arm's-length transactions.

Third, small firms may have expanded in response to changes in the relative prices of factors such as labour and capital. If capital markets improved over the post-war period, and the cost of capital for small firms has been reduced relative to large firms, then small-firm growth may just be a response to this change. Alternately, the growth in small firms may have been the result of imperfections in unionized labour markets in large firms. Faced with downward wage pressure from increasing globalization, labour markets in small firms may have offered more flexibility and small firms may have grown in response to labour market rigidities experienced by large plants.

One way to assess the strength of these various theories is to compare the changes that have occurred in Canada to the changes that have occurred in the United States. Changes in the structure of the Canadian manufacturing sector may have been caused by general factors that are common to North American industry or to factors that are specific to Canada. Finding similarities between Canada and the United States would suggest that we search for general causes rather than Canada-specific causes.

Figure 3

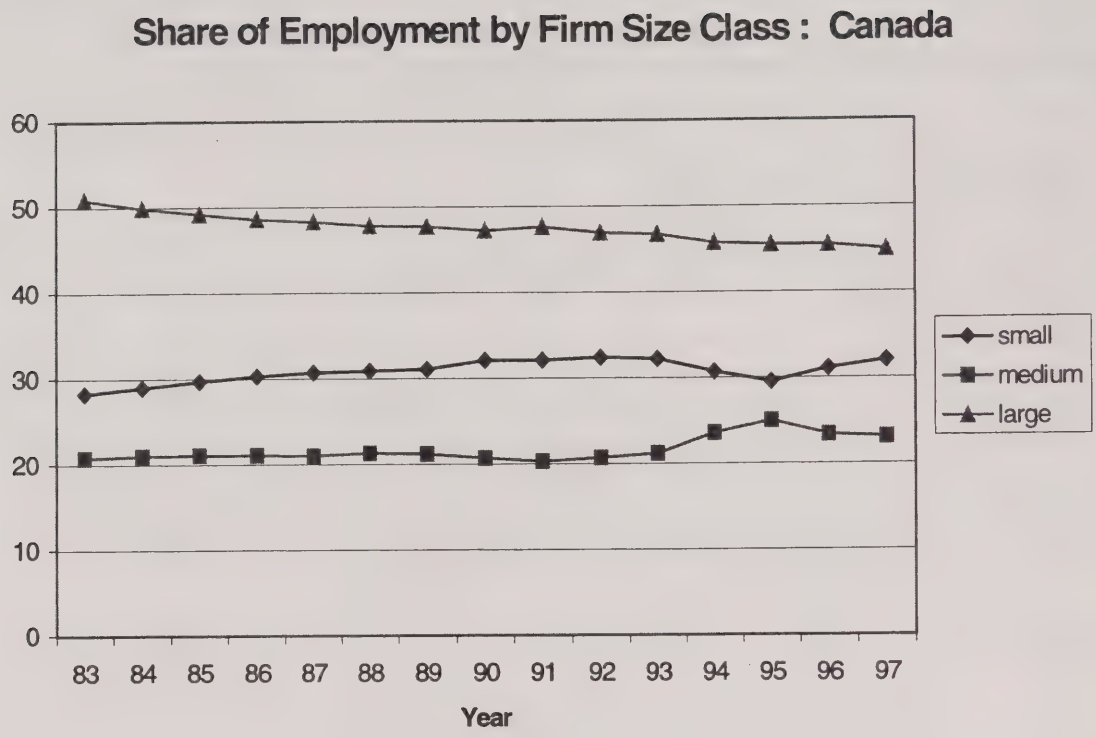
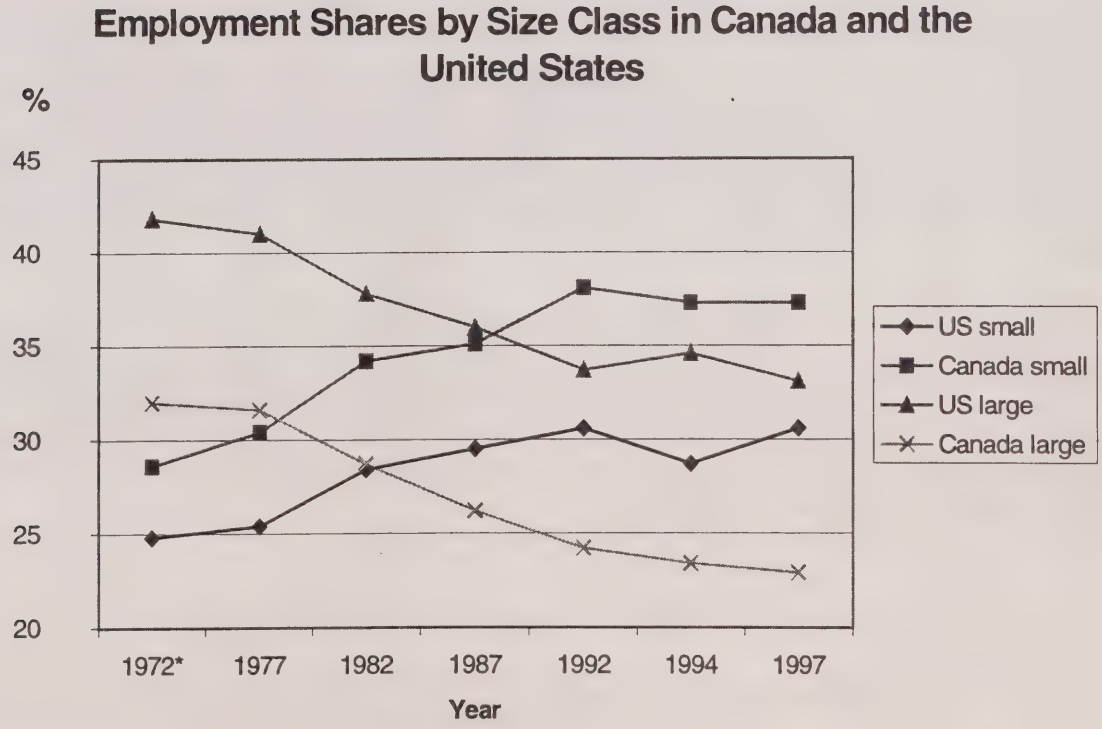


Figure 4



5.1 Data

For our comparisons, we will make use of the plant-based data for the manufacturing sector that come from the surveys that are done of this sector by Statistics Canada and by the U.S. Census Bureau. Both countries perform very similar surveys of plants in the manufacturing sector, collecting data on plants' manufacturing activities with respect to shipments, employment, materials used, and value-added. Both countries conduct these surveys at the level of the establishment or plant. Both use quite similar definitions for most variables—in particular, both distinguish between production and non-production workers, and define total employment as the sum of the two. Both measure value-added as total shipments plus changes in inventories minus expenditures on materials. Both perform essentially a census of all establishments by using both surveys and administrative data to cover the universe of plants in the manufacturing sector.

One important difference is that Canada provides comprehensive annual data but the United States only conducts a census every five years. For intervening periods, the U.S. generates annual survey data that are neither comprehensive (they omit plants with less than five employees) nor equally accurate. As the U.S. annual survey moves further away from the census year, the frame used for the annual survey misses an increasing number of new births (Davis, Haltiwanger and Schuh, 1991). It is for this reason that we choose to compare Canada and the United States only for the years in which the U.S. conducts its quinquennnial census—1972[9], 1977, 1982, 1987, 1992, and 1997.[10]

There are also minor differences in the way that both countries treat head offices. Canada includes head offices in the manufacturing survey but the United States does not—though it does include auxiliary establishments (warehousing, etc.) in its survey—as does Canada.

In this study, we include head offices in all calculations. We have experimented with removing head offices from the Canadian results and found that it has little effect on the results that we report. For example, removing head offices increases Canadian value-added per worker by about 2%. Therefore, we leave head offices in the Canadian micro file used herein.

In order to conduct the comparison, we make use of a longitudinal file with all Canadian plants classified on the basis of the 1980 SIC.[11] The U.S. data use two different SIC codes—a 1970s SIC code up to 1987 and the 1980s code from 1987 onward.

In what follows, we compare shipments, employment and value-added in small, medium and large plants in both Canada and the United States. Small plants are those with 0 to 100 employees, medium-sized plants are those with 101-500 employees, and large plants are those with over 500 employees.

---

[9] For 1972, we had to make use of 1973 data because we did not have Canadian data in 1972 classified on a 1980 SIC code.

[10] We also include U.S.data for 1994 from its Annual Census since this is the year that the annual survey expands its frame to take into account the 1992 expanded population.

[11] This was done by using commodity data on a plant's production to reclassify all plants prior to 1982 on the basis of the 1970 SIC code.

In the case of the United States, we make use of the concepts of total employment, value of shipments and census value-added estimates as are published in the U.S. Census Bureau's quinquennial censuses on manufacturing. The concepts are defined in U.S. Department of Commerce (1993). We derive the data used for the different plants size groups and the corresponding totals from micro-economic data files maintained by the Center for Economic Studies, U.S. Bureau of the Census.

For Canada, we make use of the concept of total employment, shipments and census value-added that have been described previously. These differ from what are termed manufacturing shipments and manufacturing value-added because they contain, among other items, resales of goods purchased and resold without further processing. These are derived from the Census micro-economic records. Total employment is defined as the sum of production and non-production workers.

5.2 Output and Employment Shares

The employment and output shares of small, medium, and large plants in the United States and Canada over five year periods from 1972 to 1997 are compared in Table 5.

Canada generally has a larger share (ranging from 4 to 8 percentage points) of employment in small plants. Canada also has a larger share (ranging from 2 to 6 percentage points) in the medium-sized class. In contrast, Canada has a lower share (ranging from 9 to 11 percentage points) in the largest size classes.

Of greater interest is the similarity in the trends in each category. The increase in the importance of the smallest size class and the decline in the largest size class that we have previously outlined for Canada is mirrored in the United States (Figure 4). Between 1972 and 1997, small plants gained 8.7 percentage points of employment share in Canada and 5.8 percentage points in the United States, for rates of change of 30% and 23%, respectively. Between 1972 and 1997, large plants lost 9.1 percentage points in Canada and 8.7 percentage points in the United States, for rates of change of 28% and 21%, respectively.

Moreover, both countries show the same evidence of a discontinuation of the employment shift from large to small plants during the 1990s—though the change is somewhat more abrupt in the United States.

Both countries also exhibit similar trends in terms of share of output by size class. While the share of employment in small plants increases in both countries prior to 1990, the share of output does not keep pace with the change in the share of employment. In Canada, the share of shipments in small plants is virtually the same in 1997 as in 1972. This is also the case for the United States. For value-added, the share of small plants in Canada increases slightly (by less than 2 percentage points between 1972 and 1997), while that in the United States increases by less than 0.2 percentage points.

Table 5. Comparison of Employment and Output Shares for Manufacturing Plants: Canada and the United States

Year	United States			Canada		
	% of total employment			% of total employment		
	Small	Med	Large	Small	Med	Large
1972*	24.8	33.4	41.8	28.6	39.4	32.0
1977	25.4	33.6	41.0	30.4	38.1	31.6
1982	28.4	33.7	37.8	34.2	37.1	28.7
1987	29.5	34.5	36.0	35.1	38.7	26.2
1992	30.6	35.7	33.7	38.1	37.6	24.2
1994	28.7	36.7	34.6	37.3	39.3	23.4
1997	30.6	36.4	33.1	37.3	39.8	22.9
Year	% of total shipments			% of total shipments		
	Small	Med	Large	Small	Med	Large
1972*	21.1	31.5	47.4	23.1	37.2	39.7
1977	20.4	31.2	48.4	22.0	37.0	41.0
1982	21.3	32.5	46.2	25.0	39.4	35.6
1987	21.7	32.9	45.4	24.4	38.4	37.2
1992	21.3	33.8	44.9	24.4	39.4	36.2
1994	19.9	34.3	45.7	22.5	37.8	39.7
1997	20.5	34.4	45.1	23.0	39.3	37.7
Year	% of total value-added			% of total value-added		
	Small	Med	Large	Small	Med	Large
1972*	20.9	30.5	46.4	23.4	37.6	39.0
1977	20.5	30.4	49.1	23.7	38.0	38.3
1982	22.1	31.5	46.5	27.5	38.3	34.2
1987	22.0	32.1	45.9	25.8	39.0	35.2
1992	21.9	33.0	45.1	27.3	41.0	31.8
1994	20.4	33.8	45.8	25.3	41.8	32.9
1997	21.1	33.7	45.3	25.1	41.3	33.6

* For Canada, 1973.

In large plants, there are similar declines in the share of shipments—about 2 percentage points—in both countries. The decline in the share of value-added is somewhat larger in Canada than in the United States (5 and 1 percentage points, respectively).

5.3 Relative Labour Productivity

The share of output of a size class when divided by the share of employment of the same size class provides a measure of labour productivity of that size class relative to overall labour productivity.[12] Measures of relative value-added per worker and relative shipments per worker for small, medium and large plants are provided in Table 6 for each of Canada and the United States.

[12] This provides a weighted average of labour productivity.

Table 6. Comparison of Labour Productivity for Each Plant Size Class Relative to the Industry Average: Canada and the United States

Year	United States			Canada		
	Relative value-added per employee			Relative value-added per employee		
	Small	Med	Large	Small	Med	Large
1972*	0.84	0.91	1.11	0.82	0.95	1.22
1977	0.81	0.91	1.20	0.78	1.00	1.21
1982	0.78	0.93	1.23	0.81	1.03	1.19
1987	0.75	0.93	1.27	0.73	1.01	1.35
1992	0.72	0.92	1.34	0.72	1.09	1.31
1994	0.71	0.92	1.32	0.68	1.06	1.41
1997	0.69	0.93	1.37	0.67	1.04	1.47
Year	**Relative shipments per employee**			**Relative shipments per employee**		
	Small	**Med**	**Large**	**Small**	**Med**	**Large**
1972*	0.85	0.95	1.13	0.81	0.94	1.24
1977	0.80	0.93	1.18	0.72	0.97	1.30
1982	0.75	0.96	1.22	0.73	1.06	1.24
1987	0.74	0.95	1.26	0.69	0.99	1.42
1992	0.70	0.95	1.33	0.64	1.05	1.49
1994	0.69	0.94	1.32	0.60	0.96	1.70
1997	0.67	0.95	1.36	0.62	0.99	1.65

*For Canada, 1973.

Whether we use value-added or shipments to measure output per worker, the results are similar. Small plants in both the United States and Canada have seen their labour productivity decline and the decline is quite similar in both countries. Small-plant value-added productivity declines from 84% of the average in the United States in 1972 to 69% of the average in 1997—a decline of 15 percentage points. In Canada, the decline is 11 percentage points over the same period. If shipments per worker is used, the decline is 18 and 19 percentage points in the United States and Canada, respectively. What is equally significant is that the decline continues in both countries into the 1990s.

If instead we compare the relative productivity of large plants in Canada and the United States, the results are also quite similar. Relative value-added per worker of large plants increases by 26 and 22 percentage points in the United States and Canada, respectively. There is more of a difference if shipments are used as a measure of output. Relative shipments per worker of large plants increases by 23 and 31 percentage points in the United States and Canada, respectively.

Both countries then have seen a decrease in the productivity of small plants and an increase in the productivity of large plants relative to the average of all plants. The ratio of the labour productivity of small to large plants is provided in Table 7. These ratios for value-added per worker and shipments per worker are depicted in Figures 5 and 6, respectively.[13] In the U.S, small plants actually have a slightly greater decline in value-added per worker relative to large plants than in Canada. In the United States, the decline is some 26 percentage points while in Canada it is 21 percentage points.

[13] Once again, this uses weighted averages.

Table 7. Comparison of Relative Productivity of Small Relative to Large Plants: Canada and the United States

Year	United States			Canada		
	Relative Productivity (value-added)			Relative Productivity (value-added)		
	Small/ Large	Med/ Large	Small/ Med	Small/ Large	Med/ Large	Small/ Med
1972*	0.76	0.82	0.92	0.67	0.78	0.86
1977	0.68	0.76	0.89	0.64	0.82	0.78
1982	0.63	0.76	0.83	0.68	0.87	0.78
1987	0.59	0.73	0.80	0.55	0.75	0.73
1992	0.54	0.69	0.77	0.55	0.83	0.66
1994	0.54	0.70	0.77	0.48	0.76	0.65
1997	0.50	0.68	0.74	0.46	0.71	0.65
Year	Relative Productivity (shipments)			Relative Productivity (shipments)		
	Small/ Large	Med/ Large	Small/ Med	Small/ Large	Med/ Large	Small/ Med
1972*	0.75	0.83	0.90	0.65	0.76	0.86
1977	0.68	0.79	0.86	0.56	0.75	0.75
1982	0.61	0.79	0.78	0.59	0.86	0.69
1987	0.58	0.76	0.77	0.49	0.70	0.70
1992	0.52	0.71	0.73	0.43	0.70	0.61
1994	0.52	0.71	0.74	0.35	0.57	0.62
1997	0.49	0.69	0.71	0.37	0.60	0.62

*For Canada, 1973.

It should be noted that the differences between Canada and the United States are even less if labour productivity is measured with shipments per worker. The decline in shipments per worker of small divided by large plants is about 26 percentage points in both countries (Figure 6).

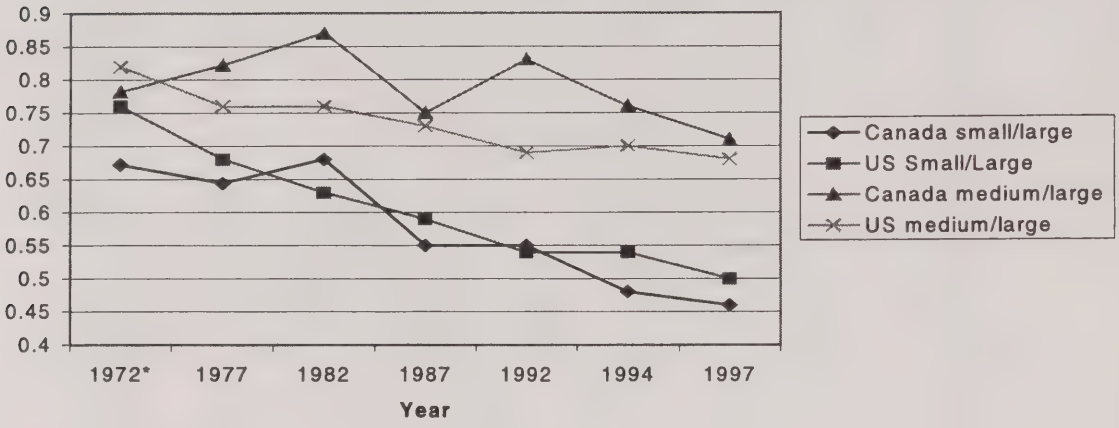
Canada shows remarkable similarities to the United States with regards to the structural changes that have occurred in the size distribution of plants in the manufacturing sector during the last twenty years. In both countries, small plants gained employment share up to the end of the 1980s. In both countries, this trend ended in the 1990s.

Equally important, the increase in small-plant employment share in both countries was not accompanied by the same increase in output share. As a result, small plants have seen their labour productivity fall relative to large plants. Moreover, this trend has continued into the 1990s.

In summary, the similarity in the structural change in the two countries means that it is unlikely that the causes of the change can be found in country-specific circumstances. That the same changes in size distribution are found in both countries suggests that the causes of restructuring must be found elsewhere—either in changes in technology or in changes that have led to more outsourcing or disintermediation.

Figure 5

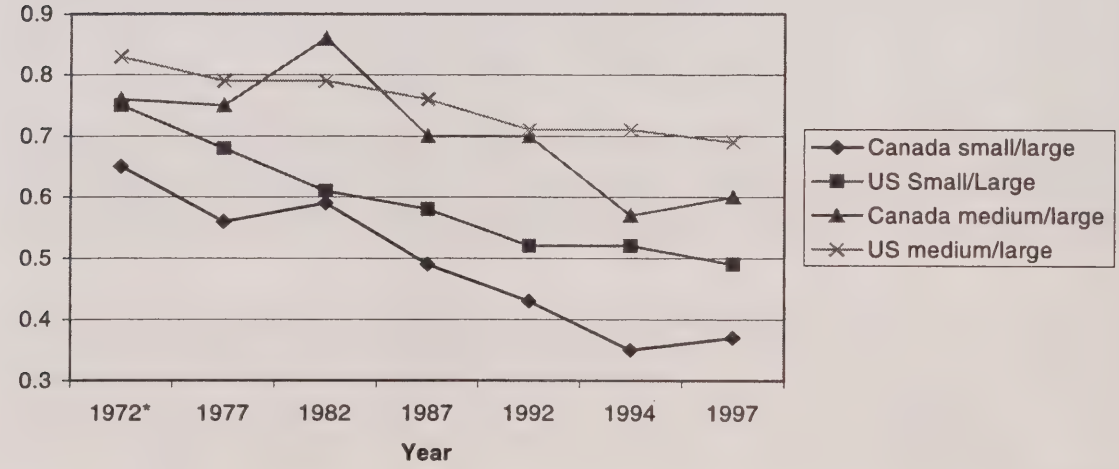
Comparison of Trends in Small and Medium Size Plant Disadvantage for Relative Value-added per Worker: Canada and the United States



*For Canada, 1973.

Figure 6

Comparison of Trends in Small and Medium Size Plant Disadvantage for Relative Shipments per Worker: Canada and the United States



*For Canada, 1973.

6. *Conclusion*

This paper has reviewed the performance of small producers in the Canadian manufacturing sector and compared it to the performance of the small producers in the United States. The plant-size changes in industrial structure in Canada mirrored those occurring in the United States over the same time period, both with respect to the changes in percentage points gains in employment share in small plants and also in terms of the percentage point declines of the relative productivity of small relative to large plants.

Between the early 1970s and 1990, the share of employment in small plants increased in both countries but this process peaked in the 1990s. At the same time, the relative labour productivity of small plants declined over the entire period.

This is the second paper that has compared the structure of the two economies using matched data from the censuses of manufactures for Canada and the United States. Earlier research by Baldwin, Dunne and Haltiwanger (1998)[14] found that the characteristics of job turnover in the two economies were quite similar in many dimensions. Despite differences in the degree of unionization, market concentration, and international trade intensity, the rates of job creation, job destruction, total job reallocation, job creation due to entry, and job destruction due to exit exhibit a number of striking similarities. First, the aggregate levels of turnover for the entire manufacturing sector and for 2-digit industries measured over annual and five-year periods were equal in magnitude. Second, correlations in these rates of changes across industries were very high, thereby indicating that patterns of inter-industry differences were quite similar. While there were slight differences in the year-to-year movements due to differences in macro-economic fluctuations, when allowance was made for these differences, the turnover rates become even more similar.

We have previously noted how remarkable these similarities are in light of the many differences in the manufacturing sectors of the two economies. Although the two countries occupy the same continent, there are significant differences in their social and economic systems. The Canadian economy is subject to more foreign competition—the export and import intensities are higher. A larger percentage of the Canadian manufacturing sector is foreign-controlled; there are higher levels of unionization in Canada, and Canadian markets are more concentrated than U.S. markets.

Plant turnover as measured by entry and exit rates, as well as job growth and job contraction, captures the amount of underlying dynamic change in an economy as some plants grow and others decline. Since Canadian plant turnover is similar to that of the United States, the explanation of turnover rates is to be found in common, not different, factors. This is strongly suggestive that the principal determinants of turnover are to be found in the technology base of an industry, since the two countries' manufacturing sectors are different in so many other

[14] See also Chapter 6 in Baldwin (1995).

dimensions. The major commonality is the production technologies that determine the degree of turnover in an industry.

This paper has shown that there are also similarities in the dynamics of change in the importance of small and large size classes. These changes also can be attributed to both technological and non-technological factors.

The increasing importance of small firms has intrigued analysts for several reasons. First, it has suggested to some that a radical change in the firm-size distribution may be about to occur—possibly because of a reduction in the importance of those factors like scale and scope economies. The traditional scale-related advantages of size, it is sometimes suggested, may have been reduced by the introduction of new advanced computer-driven technologies that have given small producers the ability to produce shorter production runs at less of a competitive disadvantage.

This explanation for the growing importance of small producers is not compatible with evidence on the differences across plant size classes in the adoption rates of new advanced manufacturing technologies. Evidence from surveys on the use of these new technologies shows that larger producers are more likely to be adopting these technologies than smaller firms (Baldwin and Sabourin, 1995). Moreover, the differences between small and large producers in Canada does not seem to have narrowed during the 1990s (Baldwin, Rama, and Sabourin, 1999).

Others have pointed out that the increasing importance of small producers might simply have arisen from a disintermediation of the production process and that large firms could simply have been outsourcing a number of functions that they once found it advantageous to perform internally. These changes may have come from new computer-based technologies that permit improved co-ordination of arm's-length transactions.

Earlier results provided some evidence that was compatible with this explanation. Baldwin (1996, 1998) pointed out that the choice of metric influenced the conclusion that small firms were increasing in importance. In particular, while small producers might well have been increasing their share of employment, there was less evidence that their share of output had increased. And, as a result, the labour productivity of small producers relative to large producers had decreased at the same time as their employment share had increased. This could well have been the result of a disintermediation process that caused large producers to divest themselves of their least productive operations.

However, the evidence is not supportive of this explanation (see Appendix 1). First, changes in a measure of disintermediation (sales/value-added ratios) over time do not correspond closely with increases in the share of employment found in small producers. The former increases in the 1970s, decreases in the 1980s, while the latter steadily increases. Second, while the change in the importance of small producers is similar in both Canada and the United States, the history of disintermediation is not the same—particularly in large producers. Canadian large producers have seen a much greater increase in their sales/value-added ratios than large U.S. producers, yet both countries have experienced the changes in the relative importance and productivity of different size classes.

Still other explanations are available for the shift of employment to smaller producers that are more country specific.

First, rigid labour markets in the large producer sector might well have led small producers to expand at the expense of large producers. Canada has a higher degree of unionization and therefore the growth of small producers may simply have been a response to labour market imperfections in its large producers.

Second, trade liberalization may be responsible for restructuring. If large multinationals, which control a major portion of Canada's manufacturing sector, have chosen to leave the country after the major trade liberalization of the late 1980s, then small producers would have become more important.

The results of this paper suggest that the country-specific explanations are not a sufficient explanation of the growth that has occurred in the small-firm sector. The similarities in the changes in the plant size distribution suggest that similarities between Canada and the United States, rather than differences, account for this change. Technology is quite similar in the two countries. It is this similar technological base to which we have previously attributed similarities in the patterns of dynamic change associated with entry, exit, job growth and job decline.

Changes in the size-class structure result from the dynamic process that sees some producers exit or contract and others grow and enter markets. Perhaps more importantly, the changes in the size-class structure can be interpreted not just to involve the dynamic replacement of some producers with others, though that is part of the process (Baldwin, 1996); they also involve changes in the underlying technology. Differences in labour productivity are closely related to differences in technology usage. Plants using advanced technologies are more productive (Baldwin, Diverty and Sabourin, 1995; Baldwin and Sabourin, 2001). Plants using advanced technologies pay higher average wages (Baldwin, Gray and Johnson, 1995; Baldwin and Rafiquzzaman, 1999). The fall in small producer labour productivity that has accompanied the transformation in industrial structure is probably closely related to differences in technology use.

In summary, while there are significant differences in the size structure of the two manufacturing sectors (the U.S. has a higher share of employment in larger plants), changes that have been occurring in the two countries are strikingly similar—at least at the level of the manufacturing sector as a whole.

Appendix 1: Disintermediation Differences

Outsourcing or disintermediation is one possible reason for both the increases in employment found in small plants and for their decreasing relative labour productivity. If large highly capital intensive plants outsourced their less capital-intensive activities, the result would be a growing small-plant segment that was less productive than large plants.

If this explanation for the growth of small plants is valid, we should expect to find that a measure of vertical integration of the plant—the ratio of value of shipments to value-added—would have changed over time, step for step, with changes in the importance of small plants. Plants that replace their internal operations by making external purchases of services or goods would expect no change in their shipments to customers but their value-added would decrease relative to their shipments—or shipments should increase relative to value-added. If a firm splits into two, the total shipments reported by the two entities would be larger than for the previous single entity, but the amount of value-added created in the two entities would be the same as in the single entity. Once more, shipments to value-added ratios would rise for the combined entities. In the economy as a whole, disintermediation would increase the amount of inter-firm transactions relative to the amount of real GDP that is created.

In order to investigate this possibility, we list the pattern of shipments to census value-added[15] in Canadian manufacturing as a whole and in each size class in Table 8 and plot these in Figure 7. Overall, the ratio of shipments to GDP shows an increase up to the SIC revision in 1982, but then it trends slowly downward. Vertical disintermediation should have been accompanied by a general increase in the ratio. At the most, this phenomenon functioned prior to the 1982 SIC revision. Since the value of shipments to value-added does not increase continuously over the period but the share of employment in small plants increases until 1990, it is difficult to ascribe changes in the importance of small plants over the period from the early 1970s to 1990 to continuous disintermediation.

There is, however, a distinct upward trend in the ratio of shipments to value-added in larger plants in the Canadian manufacturing sector. This trend is also shared by both smaller and medium-sized plants up to 1982. However, after 1982, the upward trend continues for larger plants while the ratio of shipments to value-added in smaller and medium-sized plants declines between 1982 and 1987 and then is relatively constant thereafter.

We also plot the ratio of shipments to value-added for Canada and for the United States (Figure 8). The ratio for the United States follows much the same pattern as the Canadian—with a slight upward movement in the 1970s but no increase since then. If anything there is a downward movement in the ratio in the United States since the early 1980s.

[15] As previously noted, census value-added is larger than the value-added that sums to GDP because it contains purchased services.

It is noteworthy that the ratio of shipments to value-added in Canada has always been larger than in the United States (Table 9). It was almost 14% higher in 1972. And the difference has grown over the period until it became around 24% higher by 1997. This difference has grown in all size classes (Table 9 and Figure 9). But the increase in the largest size class has been particularly large—growing from about 12% larger than the U.S. to almost 40 % larger than the U.S. by the end of the period.

A different way of examining the size-class differences is to compare the share of shipments to the share of value-added produced by a size class. These ratios are presented by size class for the United States and Canada in the second panel of Table 9. If each size class has about the same tendency to use outside sources of services and materials, then the share of shipments and value-added should be about the same. This is the case for the United States, where the ratio is about 1 for each size class and does not change much over time. In Canada, the ratios are about 1 for each size class at the beginning of the period but they decrease in the smallest size class and they increase in the largest size class. Once more, this indicates a substantial change in the largest size class in Canada relative to the same size class in the United States.

In conclusion, Canadian plants are less vertically integrated than U.S. plants at all levels. Moreover, the difference is highest in large plants and this difference has been growing over the period. Moreover, in Canada, the largest plants have been increasing their level of disintermediation relative to the smallest Canadian plants over the period.

In summary, it is difficult to ascribe the structural change that has seen small plants increase their share of employment to disintermediation. First, overall, there is little evidence from the data adduced here that disintermediation has occurred in the manufacturing sector as a whole in a monotonic fashion. Secondly, since Canada has had quite a different experience than that of the United States with regards to disintermediation in large plants, it is difficult to ascribe the similar growth in small plants and the similar decline in relative productivity of small plants to the general phenomenon of disintermediation.

Figure 7

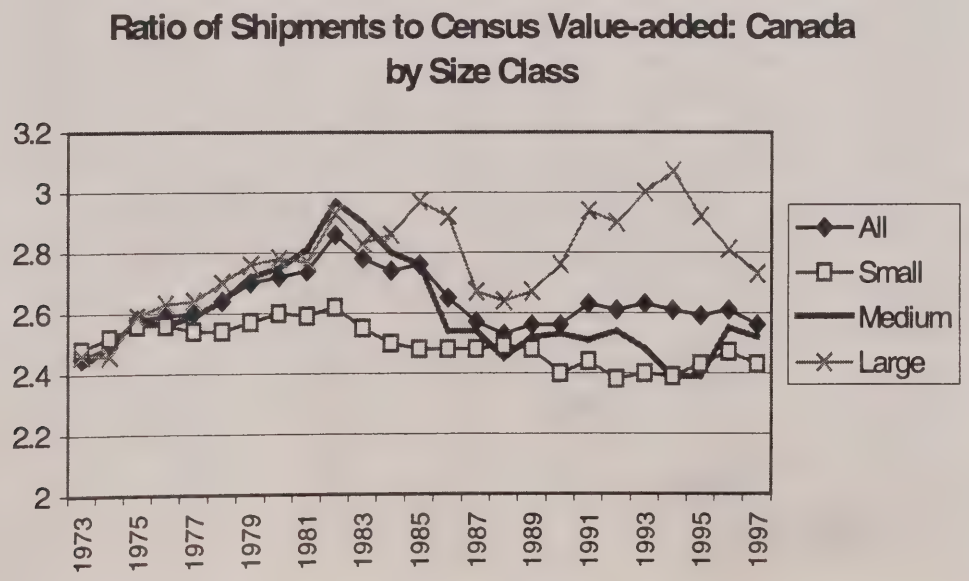


Table 8. Shipments Divided by Value-added: Canada

Year	All	Small	Medium	Large
1973	2.45	2.48	2.43	2.46
1974	2.49	2.52	2.49	2.46
1975	2.58	2.56	2.58	2.59
1976	2.59	2.56	2.56	2.63
1977	2.60	2.54	2.59	2.64
1978	2.64	2.54	2.64	2.70
1979	2.70	2.57	2.72	2.76
1980	2.72	2.60	2.75	2.78
1981	2.74	2.59	2.81	2.77
1982	2.86	2.62	2.97	2.93
1983	2.78	2.55	2.90	2.83
1984	2.74	2.50	2.80	2.86
1985	2.76	2.48	2.76	2.97
1986	2.65	2.48	2.54	2.92
1987	2.57	2.48	2.54	2.67
1988	2.53	2.49	2.45	2.64
1989	2.56	2.48	2.52	2.67
1990	2.56	2.40	2.53	2.76
1991	2.63	2.44	2.51	2.94
1992	2.61	2.38	2.54	2.90
1993	2.63	2.40	2.48	3.00
1994	2.61	2.39	2.39	3.07
1995	2.59	2.43	2.39	2.92
1996	2.61	2.47	2.55	2.81
1997	2.56	2.43	2.52	2.73

Table 9. Comparison of shipments to value-added by plant size class: Canada and the U.S.

Year	United States				Canada			
	Shipments divided by value-added				Shipments divided by value-added			
	All	Small	Med	Large	All	Small	Med	Large
1972*	2.14	2.16	2.21	2.18	2.45	2.48	2.43	2.46
1977	2.32	2.31	2.38	2.29	2.60	2.50	2.59	2.64
1982	2.38	2.30	2.45	2.37	2.86	2.62	2.97	2.93
1987	2.12	2.09	2.18	2.10	2.57	2.48	2.54	2.67
1992	2.11	2.05	2.16	2.10	2.61	2.38	2.54	2.90
1994	2.09	2.04	2.12	2.08	2.61	2.39	2.39	3.07
1997	2.06	2.01	2.10	2.05	2.57	2.43	2.52	2.73

Year	United States			Canada		
	Share of shipments divided by share of value-added			Share of shipments divided by share of value-added		
	Small	Med	Large	Small	Med	Large
1972*	1.01	1.03	1.02	0.99	0.99	1.02
1977	1.00	1.03	0.99	0.93	0.97	1.07
1982	0.96	1.03	0.99	0.91	1.03	1.04
1987	0.99	1.02	0.99	0.95	0.98	1.06
1992	0.97	1.02	1.00	0.89	0.96	1.14
1994	0.98	1.01	1.00	0.89	0.90	1.21
1997	0.97	1.02	1.00	0.92	0.95	1.12

*For Canada, 1973.

Figure 8

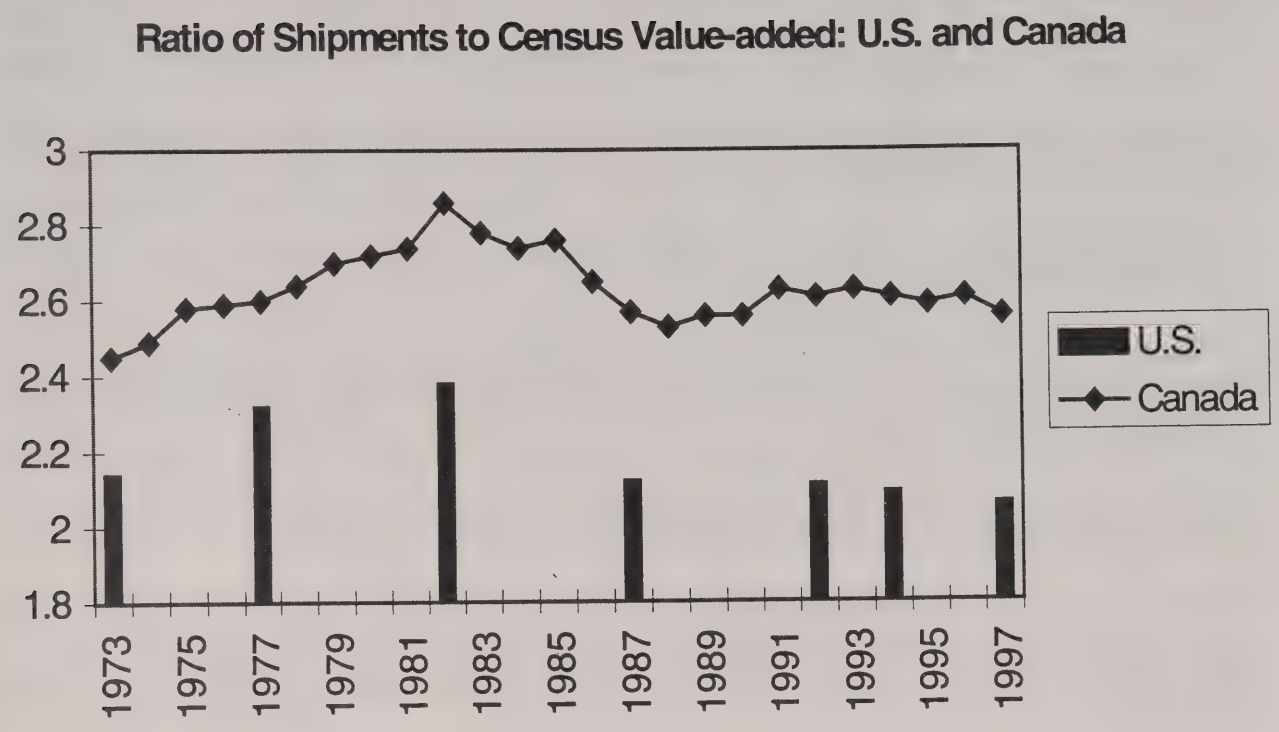
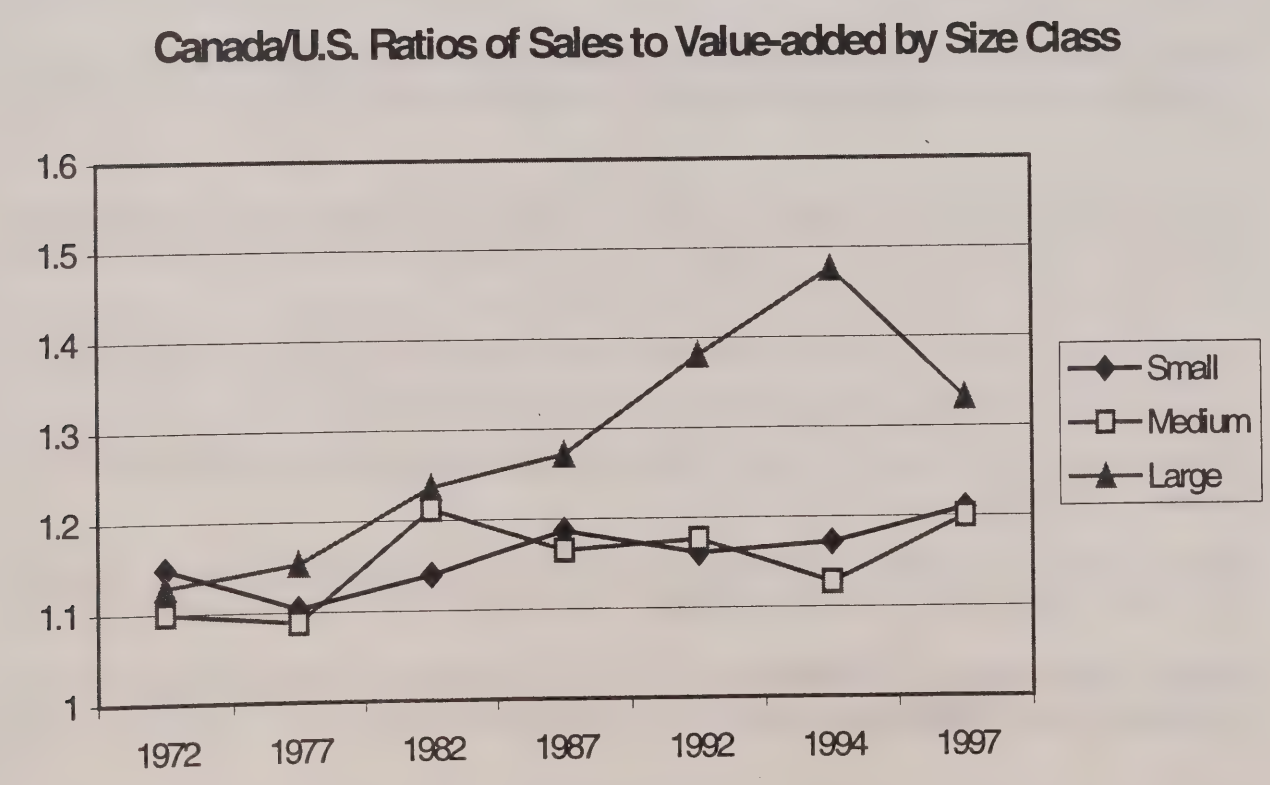


Figure 9



References

Acs, Z.S. and D.B. Audretsch. 1990. *Innovation and Small Firms*. Cambridge, Mass.: MIT Press.

Armington, Catherine and Marjorie Odle. 1982. "Small Business: How Many Jobs?" The Brookings Review 1 (Winter): 7-14.

Baldwin, John R. 1995. *The Dynamics of Industrial Competition: A North American Perspective.* Cambridge: Cambridge University Press.

Baldwin, John R. 1996. "Productivity Growth, Plant Turnover and Restructuring in the Canadian Manufacturing Sector." In *Sources of Productivity Growth.* Edited by David Mayes. Cambridge: Cambridge University Press.

Baldwin, John R. 1998. "Were Small Producers the Engines of Growth in the Canadian Manufacturing Sector in the 1980s." *Small Business Economics* 10: 349-64.

Baldwin, John R., Desmond Beckstead and Richard E. Caves. 2001. *Changes in the Diversification of Canadian Manufacturing Firms and Plants (1973-1997): A Move to Specialization.* Research Paper 11F0019MPE No. 179. Analytical Studies Branch. Statistics Canada.

Baldwin, John, Brent Diverty and David Sabourin. 1995. In T. Courchene (ed.) *Technology, Information, and Public Policy.* John Deutsch Institute for the Study of Economic Policy. Kingston, Ontario: Queens University.

Baldwin, John, Tim Dunne and John Haltiwanger. 1998. "A Comparison of Job Creation and Job Destruction in Canada and the United States." *Review of Economics and Statistics.* 80: 347-57.

Baldwin, John R., Richard Dupuy and William Penner. 1992. "Development of Longitudinal Data from Business Registers: Canadian Experience," *Statistical Journal of the United Nations, Economic Commission for Europe* 9: 289-304.

Baldwin, John, Tara Gray and Joanne Johnson. 1995. "Advanced Technology Use and Training in Canadian Manufacturing," *Canadian Business Economics*.5: Fall, 1996. 51-70.

Baldwin, John R. and Paul K Gorecki. 1990. *Structural Change and the Adjustment Process.* Ottawa: The Economic Council of Canada.

Baldwin, John R. and Paul K. Gorecki. 1994. "Dimensions of Labour-Market Change in Canada: Intersectoral Shifts, Job and Worker Turnover." *Journal of Income Distribution.* 3: 148-180.

Baldwin, John R. and Garnett Picot. 1995. "Employment Generation by Small Producers in the Canadian Manufacturing Sector." *Small Business Economics* 7: 1-14.

Baldwin, John and Mohammed Rafiquzzaman. 1999. "Trade, Technology and Wage Differentials in the Canadian Manufacturing Sector," in *Innovation, Industry Evolution and Employment*. Edited by D.B. Audretsch and R.A. Thurik. Cambridge University Press. pp. 57-85.

Baldwin, John, Ed Rama and David Sabourin. 1999. *Growth of Advanced Technology Use in Canadian Manufacturing During the 1990s*. Research Paper 11F0019MPE No. 105. Analytical Studies Branch. Ottawa: Statistics Canada.

Baldwin, John R. and David Sabourin. 1995. *Technology Adoption in Canadian Manufacturing*. Catalogue 88-512-XPB. Analytical Studies Branch. Ottawa: Statistics Canada.

Baldwin, John R. and David Sabourin. 2001. *Impact of the Adoption of Advanced Information and Communications Technologies on Firm Performance in the Canadian Manufacturing Sector*. Research Paper 11F0019MPE No. 174. Analytical Studies Branch. Ottawa: Statistics Canada.

Birch, David. 1981. "Who Creates Jobs?" *The Public Interest* 65: 3-14.

Birch, David. 1987. *Job Creation in America*. New York: The Free Press.

Brown, C., J. Hamilton and J. Medoff. 1990. *Employers Large and Small*. Cambridge, Mass: Harvard University Press.

Davis, S.J., J. Haltiwanger and S. Schuh. 1991. "Published versus Sample Statistics from the ASM: Implications for the LRD". Working Paper #91-1. U.S. Center for Economic Studies. U.S.Bureau of the Census. Washington.

Davis, S.J., J. Haltiwanger and S. Schuh. 1993. Small Business and Job Creation: Dissecting the Myth and Reassessing the Facts. Working Paper No. 4492. National Bureau of Economic Research.

Davis, S.J., J. Haltiwanger and S. Schuh. 1996. *Job Creation and Destruction*. Cambridge, Mass. MIT Press.

Kirchoff, B.A. and B.D. Phillips. 1988. "The Effect of Firm Formation and Growth on Job Creation in the United States," *Journal of Business Venturing* Vol. 3.

MacDonald, James M. 1985. "Dun and Bradstreet business microdata research applications, and the detection and correction of errors." *Journal of Economic and Social Measurement* 13: 173-85.

Morissette, R. 1993. "Canadian Jobs and Firm Size: Small firms pay less?" *Canadian Journal of Economics* 26: 159-74.

Organization for Economic Cooperation and Development. 1985. "Employment in Small and Large Firms: Where Have the Jobs Come From?" *Employment Outlook* Paris: OECD pp. 64-82.

Picot, G, J.R. Baldwin and R. Dupuy. 1995. "Small Firms and Job Creation—A Reassessment." *Canadian Economic Observer*. Ottawa: Statistics Canada. January 3.1-3.18.

Picot, G. and R. Dupuy. 1996. "Job Creation by Company Size Class: The Magnitude, Concentration and Persistence of Job Gains and Losses in Canada." *Small Business Economics* 10: 117-139.

Reynolds, Paul D., Stephen West and Michael D. Finch. 1985. "Estimating new firms and new jobs: Consideration in using the Dun and Bradstreet Files." In *Frontiers of Entrepreneurship Research.* Edited by John A. Hornaday, Edward Shils, Jeffrey A. Timmons and Karl H. Vesper. Wellesley Mass: Babson College.

Rothwell, R. and W. Zegveld. 1982. *Innovation in the Small and Medium-Sized Firm*. London: Francis Pinter.

Storey, David and Steven Johnson. 1986. "Job Generation in Britain: A review of recent studies." *International Small Business Journal* 4: 29-46.

U.S. Department of Commerce. 1993. 1987 Economic Censuses Cd-rom Report Series. Release 1E. Part 2.

ECONOMIC ANALYSIS (EA)
RESEARCH PAPER SERIES

No. 001 *A Comparison of Canada-U.S. Economic Growth in the Information Age, 1981-2000: The Importance of Investment in Information and Communication Technologies,* Philip Armstrong, ***Tarek M. Harchaoui, Chris Jackson and Faouzi Tarkhani (March 1, 2002)***

No. 002 *Purchasing Power Parity: A Canada/U.S. Exploration,* ***Beiling Yan (May 2002)***

No. 003 *The Trend to Smaller Producers in Manufacturing: A Canada/U.S. Comparison,* ***John Baldwin, Ron S. Jarmin, Jianmin Tang (May 2002)***

No. 004 *Foreign Affiliate Trade Statistics – 1999: How Goods and Services are Delivered in International Markets,* ***Colleen Cardillo (April 2002)***